ROLLER

BACKGROUND OF THE INVENTION

1. FIELD OF THE INVENTION

The present invention relates to a roller with a pair of crawlers on both sides of its (vehicle) body. Furthermore, the present invention relates to a compaction method of the ground of the sloping ground using a roller (vehicle).

2. PRIOR ART

As shown in FIG. 12, a vibratory roller 31, in which a vibratory roll 32 is served as the front wheel and a tire T is served as the rear wheel, is conventionally used as one of roller. The roller, such as a vibratory roller, has been used in the compaction of the not steep slope or small uneven ground.

A vibrating shaft 34, which is consists of one axis, and to which the eccentric weight 33 is fixed, is installed within the vibratory roll 32 (herein after defined as the roll). When the vibrating shaft 34 rotates, the roll 32 is vibrated by the eccentric rotation of the vibrating shaft 34, and the vibration force is applied in the 360-degree direction of the periphery of the roll 32, and thus the slope (sloping ground) is compacted.

When the compaction using the vibratory roller 31 is carried out under the disadvantageous condition, such as extremely uneven ground or the muddy land of the construction site of a highway or a dam, and such as the sloping ground (slope), the operation of the vibratory roller 31 with

stableness may be disturbed by the slipping or the sticking of the tire T in the mud. For settling these phenomenon, the applicant of the present patent application discloses the crawler-type vibratory roller for earthwork in the Japanese unexamined patent publication No. 07-3764. According to the disclosed crawler-type vibratory roller, the operation of the vehicle with stableness can be achieved even in the muddy road and the steep sloping ground and the like. The working efficiency thus can be maintained.

When detaching the crawlers from the vehicle body for repairing or replacing, however, the crawlers equipped on both sides of vehicle body are detached separately. The attaching and detaching operation of the crawler thus will be bothered. Furthermore, since the vibratory roller is frequently used in the compaction of the asphalt pavements as well as that of the embankment, it is uneconomical in the traveling efficiency to operate the vibratory roller equipped with the crawler even in the asphalt road surface by which the trafficability is stabilized.

Therefore, the roller, in which the attaching and detaching operation of the crawler is carried out with ease, and the roller which can fully demonstrates the traveling performance depending on the situation of the ground to be compacted, have been required.

In the conventional method for achieving the compaction of the sloping ground using the vibratory roller, the following

difficulties had been arisen. Generally, the slip of the wheel will be arisen when the driving force at the tread exceeds the shear resistance force of the ground, and in this case the traveling condition becomes unstable.

Therefore, when the vibratory roller climbs a sloping ground, since the inclination of the vehicle body and the jumping of the roll 32, which is caused by the reaction force from the ground, are affected as the compaction progresses, the load applied to the wheel, i.e., a tire T, and the fluctuation thereof are increased. Consequently, the slip of the tire is arisen by the jumping of the roll 32 and the inclination of the vehicle body, and then the vehicle body tends to become unstable.

Specifically, according to the vibratory mechanism of the roll 32, since the vibration force is applied to the roll 32 along the 360-degree direction of the periphery by the rotation of the eccentric weight 33, the roll 32 is vibrated.

The measurement value of the wave profile in the ups-and-downs and front-and-rear directions to the vehicle of the vibration acceleration, which is applied to the roll 32, is shown in FIG. 13A. The wave composite of the vibration acceleration is shown in FIG. 13B. As can be seen from FIG. 13B, the wave composite of the vibration acceleration is displacing and rotating along the ellipse-shaped locus centering on the axial center of the roll 32. According to this wave composite, since the reaction force is applied in all

directions from the cross direction to the perpendicular direction at the tread, the vehicle body inclining at the sloping ground tends to become unstable.

When the component in the front-and-rear directions of the vibration force of the roll 32 is slightly deviated from the center (center of gravity) in the longitudinal direction of the vibratory roller 31, the vibration force is given to the vibratory roller 31 whole as a moment. Thus, the steering of the vibratory roller 31 becomes difficult.

The degree of the unstableness of the roll 32 is further increased by the slight unbalance of the weight in the longitudinal direction of the roll 32, the slight difference in the rigidity of vibration proof rubbers of left side and right side (not shown) between which the roll 32 is supported, and the difference of the reaction force from the ground which is affected by the soil and the shape of the ground. As a result of these unstableness, the jumping of the roll 32 will be promoted.

In the compaction of the sloping ground, particularly, since the direction of the center of gravity of the vehicle body (the gravity direction) does not serve as perpendicular with respect to the slope surface, when the load fluctuation to the tire T and the slip phenomenon of the tire T are coupled thereto, the degree of the unstableness of the vehicle body is increased. Thus, the operationablity of the steering wheel becomes difficult and then the keeping of the attitude of the vehicle

body becomes difficult.

Therefore, there has been required that the vibratory roller, which can compact the ground on stabilizing the vehicle body even in the steep sloping ground, and the compaction method of the sloping ground using the vibratory roller.

SUMMARY OF THE INVENTION

The present invention is originated for attaining these requirement, and objects to supplying rollers, such as vibratory rollers, as follows. 1) a roller which can fully demonstrates the traveling performance depending on the condition of the ground to be compacted. 2) a roller in which the attaching and detaching operation is carried out with ease. 3) a roller which can compact the ground on stabilizing the vehicle body even in the steep sloping ground. Furthermore, the present invention objects to supplying the compaction method of the sloping ground using the roller, such as vibratory roller.

For attaining these requirement, there is provided a roller equipped with a pair of crawlers on both sides of it's (vehicle) body, comprising: a pair of driving wheels attached on both sides of a driving shaft of the crawlers, each of said driving wheels being detachable from the driving shaft; a set of right-and-left driven wheels for the crawlers arranged on both sides of the (vehicle) body; and a connecting member integrally supporting the set of right-and-left driven wheels,

said connecting member is attached on a bottom of the (vehicle) body and is detachable from the (vehicle) body with the set of driven wheels attached thereto. According to this roller, the efficiency of the attaching and detaching operation of the crawler is improved.

In the roller, preferably, crawlers are replaceable with a pair of tires, and each of said tires being detachable from driving shaft. According to this roller, the traveling performance can fully be demonstrated by replacing the crawler with the tire mutually depending on the condition of the ground to be compacted.

In the present invention, furthermore, there is provided a roller, wherein said roller is a vibratory roller in which a vibratory roll is connected to the (vehicle) body in an articulating manner, and wherein said driving shaft positions above a rotating shaft of the vibratory roll so that the (vehicle) body inclines with respect to the horizontal plane. According to this roller, the degree of the inclination angle of the vehicle body at the time of compaction on the sloping ground can be smaller, and the degree of the mental pressure which is brought to the operator himself by the inclination of the vehicle body is alleviated.

The roller, preferably, further comprising roll having a perpendicularly vibratory mechanism, which vibrates the roll only in the perpendicular direction with respect to the ground surface.

In the present invention, there is provided a compaction method of the sloping ground using the roller wherein said pair of crawlers are attached to the (vehicle) body, and wherein a compaction is carried out while said vibratory roll is vibrating only perpendicularly to the ground.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1A is an explaining side view of a roller (vibratory roller) according to the present invention.

FIG. 1B is an explaining plan view of a roller (vibratory roller) according to the present invention.

FIG. 2 is an explaining side view of the crawler located at the left side of the vehicle body.

FIG. 3 is sectional view along the line A-A in FIG. 2.

FIG. 4 is an explaining plan view of a connecting member 16.

FIG. 5 is a plan view looked from the arrowhead B-side in FIG. 4.

FIG. 6 is a schematic perspective view of a connecting member.

FIG. 7 is an explaining side view of a vibratory roller in which tire is equipped instead of the crawler.

FIG. 8 is an explaining side view of a compaction of the sloping ground using a vibratory roller equipped with the crawler.

~~FIG. 9 is an explaining view of the function of the~~

SUB A1

A1 cont

~~perpendicularly vibratory mechanism.~~

FIG. 10 is an explaining view of the function of a method of the compaction according to the present invention.

Sub A2

~~FIG. 11A is a graph showing the wave profile in the ups-and-downs and front-and-rear directions of the vibration acceleration, which is applied to the roll by the perpendicularly vibratory mechanism.~~

FIG. 12 is an explaining view of a conventional method of the compaction.

Sub A3

~~FIG. 13A is a graph showing a wave profile in the ups-and-downs and front-and-rear directions of the vibration acceleration, which is applied to the roll by the conventional perpendicularly vibratory mechanism.~~

DESCRIPTION OF THE PREFERRED EMBODIMENTS

As one of the preferred embodiment of the present invention, a roller, which is designed as a vibratory roller in which vibratory roll is equipped in articulating manner, will be explained as follows.

As shown in FIG. 1, a vibratory roller 1 is composed of a vehicle body 3, on both sides of which crawlers 2 are equipped, and a machine frame 5, which has the casing shape in plan viewing. A roll 4 is rotatablely supported between the frames, which are faced each other within the machine frame, and disposed at the front side of the vehicle body 3. The vehicle body 3 and the machine frame 5 are joined in articulating manner through a

connecting part 6. A cab seat 7 is provided on the vehicle body 3. The model shown in drawing serves as the cabin specification vehicle with the cabin 8 surrounding the cab seat 7.

When the steering wheel in the cab seat 7 is operated, the vehicle body 3 and the machine frame 5 mutually turn in the left-and-right direction by the actuation of the oil hydraulic cylinder for steering (not shown). If the waviness (unevenness) and the like exists in the left-and-right direction of the road surface, the vehicle body 3 and the machine frame 5 tilt around the base axis of the front-and-rear directions along the waviness.

The vibrating equipment, which has the perpendicularly vibratory mechanism, and which will be explained later in detail, is installed within the roll 4. The compaction of the ground is carried out while vibrating the roll 4 by the actuation of the vibrating equipment through the ON operation of the switches arranged near the cab seat 7.

A differential unit (a differential gear) (not shown) is disposed at the bottom part of the vehicle body 3. FIG. 2 is a side view of the crawler 2 located on the left side of the vehicle body 3. FIG.3 is a sectional view along the line A-A in FIG. 2.

As shown in FIG. 3, a chassis of the differential unit is composed of a differential-housing DH, into which the differential gear (not shown) and the like are installed, and axle-shaft housings AH of the right-and-left couple, which

prolong in the longitudinal direction and store the axle-shaft AS therein. The axle-shaft housings AH are integrally fixed at the both side ends of the differential-housing DH.

At the upper and lower part of each of the axle-shaft housing AH, an upper attachment plate AHa and a lower attachment plate AHb, which are prolonged toward the front-and-rear directions of the vehicle, are horizontally fixed so that the upper attachment plate AHa and the lower attachment plate AHb face each other.

At the upper attachment plate AHa and the lower attachment plate AHb, total of four through-holes AHc are provided respectively. Two of four through-holes AHc are provided in the rear-side direction of the vehicle than the axle-shaft housing AH. The two remaining are provided in the front-side direction of the vehicle than the axle-shaft housing AH.

A symbol 11 indicates a frame plate, which constitutes the bottom part of the vehicle body 3. Through-holes 11a are bored to the frame-plate 11 at the position corresponding to the through-holes AHc of the upper attachment plate, so that the through-holes 11a and the through-holes AHc are in agreement when the upper attachment plate AHa is applied to the frame plate 11.

Therefore, when the bolt 12 is penetrated into the through-hole 11a and the through-hole AHc from the upper part of the frame plate 11, and screwing the nut 13 to the bolt 12

at the bottom surface of the lower attachment plate AHb on applying the upper attachment plate AHa to the frame plate 11, the differential-housing DH and the axle-shaft housing AH are fixed to the under part of the vehicle body 3.

In the present invention, as for the crawler 2, as shown in FIG. 3, the crawler 2 is characterized in that the driving wheel 14 is detachably attached to the driving shaft (axle-shaft AS), and the connecting member 16, which can integrally support the driven wheel 15 of the crawlers 2 of both side, is detachably attached to the bottom part of the vehicle body 3 (also see FIG. 4, FIG. 5, and FIG. 6).

FIG. 4 is a plan view of the connecting member 16. FIG. 5 is a plan view looked from the arrowhead B-side in FIG. 4. FIG. 6 is a schematic perspective view of the connecting member 16.

As shown in FIG. 3, a hub 17 and 17 are attached at the tip of the axle-shafts AS of left-and-right side, and the driving wheel 14 and 14 are detachably attached to the hub 17 and 17 using the hub bolt 18 and the hub nut 19, respectively. In the present preferred embodiment, as can be seen in FIG. 2, a crawler track 20 is put wound so that it might present the triangle shape in the side viewing on the condition that the driving wheel 14 is arranged at the top-most-vertices side.

In the present preferred embodiment, furthermore, a rubber crawler is used as the crawler 2, in which the crawler track 20 is made of a rubber material. As shown in FIG. 2, the

driven wheel 15 is composed of a front-side driven wheel 15a, a rear-side driven wheel 15b, and a guide rolls 15c, 15d, and 15e. The front-side driven wheel 15a and rear-side driven wheel 15b have large diameter and are arranged at the front end and the rear end, respectively. The guide roll 15c, 15d and 15e have a small diameter and are arranged between the front-side driven wheel 15a and rear-side driven wheel 15b.

As shown in FIG. 2 or FIG. 6, the front-side driven wheel 15a and the rear-side driven wheel 15b are rotatably supported at a front part bracket 22 and a rear part bracket 23, respectively. The front part bracket 22 and the rear part bracket 23 are fixed to the flame 21 for the driven wheel which is prolonged in the front-and-rear directions of the vehicle.

The guide roll 15c is rotatably supported by a bracket 25, which is attached to the frame 21 for driven wheel so that it can pivot on a basis shaft 24. The guide roll 15d and 15e are rotatably supported by a bracket 27. The bracket 27 is attached to the frame 21 for driven wheel so that it can pivot on a basis shaft 26 and it can move in the vertical direction.

Each of the driven wheels 15 (the front-side driven wheel 15a, the rear-side driven wheel 15b, and the guide rolls 15c, 15d, and 15e) are equipped on the crawler 2 as a right-and-left couple, respectively (in the FIG. 3, the guide roll 15c and 15c are equipped as a right-and-left couple is indicated). Thus the bracket 25 and the bracket 27 are also equipped on the crawler 2 as a right-and-left couple.

As shown in FIG. 3 and FIG. 6, a bracket 28 is horizontally fixed to the upper part of the frame 21 for the driven wheel. A vertical bracket 29 and 30 are vertically fixed to the bracket 28 so that the face of the vertical bracket 29 and 30 should become parallel mutually along the front-and-rear directions of the vehicle on the condition of having faced mutually.

As shown in FIG. 6, a through-hole 29a and 30a are bored to the vertical bracket 29 and 30, respectively. The cylindrical cylinder-shaped member 31 is fixed by the welding and the like in the condition of having been inserted in the through-holes 29a and 30a. Hereinafter, A sub assembly, which is composed of the frame 21 for driven wheel, onto which each driven wheels 15 are attached, the bracket 28, the vertical bracket 29 and 30, and the cylinder-shaped member 31, is defined as a driven wheel unit U.

Referring to FIG. 3 through FIG. 6, the explanation about the connecting member 16 will be carried out. The connecting member 16 has beam members 32 of front-and-rear couple, which are prolonged in the longitudinal direction.

In the present preferred embodiment, the beam member 32 is made of a steel pipe. An inner connecting plates 33 of the right-and-left couple, which present an elliptic shape in side viewing, are arranged at the vicinity of the center in the longitudinal direction of the beam member 32, respectively. An outer connecting plate 34 and 34 of the right-and-left couple are arranged at the end face of the outer side in the

longitudinal direction of the beam member 32, respectively. The beam member 32 is united with the inner connecting plates 33 and the outer connecting plates 34 into integral body.

At the outer surface side of the outer connecting plates 34 of left-and-right, an axis member 35 and 35, which are prolonged in the longitudinal direction, are protrudedly disposed so that the axis members 35 and 35 are arranged in the coaxial condition mutually.

As shown in FIG. 3, the cylinder-shaped member 31 is rotatably attached to the axis member 35 through a bearing 42 and 42. As can be seen in FIG. 6, since the driven wheel unit U is pivotally attached to the connecting member 16, each of the driven wheels 15 of the crawlers 2 of left-and-right side are integrally supported by the connecting member 16.

A first attaching plate 36 and 36 are horizontally fixed to the upper part of the outer connecting plates 34 of right-and-left. A second attaching plate 37 and 37 are slantingly fixed on the front-side direction of the vehicle than the first attaching plates 36.

As shown in FIG. 4, a plurality of through-holes 37a are bored to the second attaching plate 37 (in this embodiment, there are four through-holes 37a). As shown in FIG.2, the second attaching plate 37 is fixed to the frame plate 38, which is slantingly fixed to the bottom part of the vehicle body 3, by fastening the bolt to the nut 40 on applying the second attaching plate 37 to the frame plate 38.

In the present embodiment, furthermore, the attachment of the first attaching plate 36 to the vehicle body 3 is carried out using the bolt 12 and the nut 13 which are used for fixing the axle-shaft housing AH and the differential-housing DH to the vehicle body 3 (FIG. 3).

In other word, the connecting member 16 and the axle-shaft housing AH are attached to the vehicle body 3 by fastening together. As shown in FIG. 4, FIG. 6, and other Figures, a plurality of through-holes 36a are bored to the first attaching plate 36. As shown in FIG. 3, the first attaching plate 36 is detachably tightened and fixed to the bottom part of the axle-shaft housing AH by fastening the bolt 12 to the nut 13 in the condition that the first attaching plate 36 is applying to the lower attachment plate AHb.

If it is designed so that the first attaching plate 36 is tightened and fixed to the axle-shaft housing AH by using all of the bolt 12 and the nut 13, when the bolt 12 and the nut 13 are removed for detaching the connecting member 16 from the vehicle body 3 in the case of the maintenance or the replacement, for example, the axle-shaft housing AH and the differential housing DH are simultaneously detached from the vehicle body 3. Thus the operation will be troublesome.

For resolving these disadvantages, a notching part 41 with a suitable size for enabling the screwing operation of the bolt 12 to the nut 13 without interference is provided to the first attaching plate 36 as shown in FIG. 4 and FIG. 6. At the

notching part 41, only the axle-shaft housing AH and the differential housing DH are tightened and fixed to the vehicle body 3 by the bolt 12a and the nut 13a (in the FIG. 3, for easily recognize, symbols 12a and 13a are used instead of symbol 12 and 13 for indicating the bolt and the nut, which are located at the notching part 41, respectively).

On the other hand, at the through-holes 36a, the first attaching plate 36 is tightened and fixed to the vehicle body together. In other words, the connecting member 16 and the axle-shaft housing AH are tightened and fixed to the vehicle body 3 together at the position of the through-hole 36a.

According to this construction, the axle-shaft housing AH and the differential-housing DH will be in the tightened and fixed condition to the vehicle body 3 by the bolt 12a and the nut 13a even if the connecting member 16 is detached from the vehicle body 3 by unscrewing the bolt 12 from the nut 13. As for this construction, a through-hole may be acceptable instead of the notching 41 as long as it has a suitable diameter for enabling the screwing operation of the bolt 12 to the nut 13 without interference.

As described above, as for the crawler 2, when the driving wheels 14 are detachably attached to the driving shaft (axle-shaft AS), and the connecting member 16, which can integrally support the driven wheel 15 of the crawlers 2 of left-and-right side, is detachably attached to the bottom part of the vehicle body 3, the detaching operation of the crawler

2 from the vehicle body 3, which is carried out in the case of the repairing and the replacing, for example, will be achieved with ease as compared to the conventional.

As shown in FIG. 7, when the roller is designed so that the crawler is replaceable with a tire T and the tire is also detachably attached to the driving shaft (axle-shaft AS), it is useful because the replacing operation between the tire T and the crawler 2 can be easily carried out in the construction site depending on the operating situation.

When detaching the crawler 2 for replacing with the tire T, the detaching operation is achieved with ease only by removing the driving wheel 14 and the connecting member 16 from the axle-shaft AS and the bottom part of the vehicle body 3, respectively. In this case, the driving wheel 14 and the connecting member 16 are removed by unscrewing the bolt 12 from the nut 13 (FIG. 3) and the bolt 39 from the nut 40 (FIG.2), respectively, on attaching the driven wheel unit U shown in FIG. 6 as it is.

The Detailed drawing at the time of equipping an axle shaft AS with Tire T is omitted. When attaching the tire T, the tire T is tightened and fixed to the hub 17 using the hub bolt 18 and hub nut as it is, which were used for attaching the driving wheel 14.

The vibratory roller is used in the compaction of the embankment by which the traveling motion tends to be unstable by the irregularity, and also used to the compaction of the

asphalt pavement by which the traveling motion is stabilized. Thus, the vibratory roller in which the tire T and the crawler 2 were provided as replaceable is fully useful.

Suitable use of the tire T and the crawler 2 is different. For example, when the vibratory roller is used in the usual compaction such as in the flat grounds, the tire T is attached. On the other hand, when the vibratory roller is used in the compaction of the sloping ground (slope) or the muddy road after rainfall, the crawler 2 is attached so that the ground pressure is dispersed uniformly and the anti-slipping performance is demonstrated.

In the construction site, such as a highway or a dam, the compaction tends to be carried out in the steep sloping ground of more than 20-degree in sloping angle. Thus, if the operation is continued in the condition that the vehicle body 3 is being inclined greatly along this inclined plane, the operator tends to give the mental pressure himself.

Under these conditions, furthermore, since the cab seat 7 is also inclined along with the inclination of the vehicle body 3, operator is exposed to the condition of being inclined to the upper or the lower. When the operation is continued in the inclined condition for a long time, the tiredness of operator may increase as compared to the compaction in the level ground.

In the present embodiment, as can be seen from FIG. 1A, the vehicle body 3 is inclined with respect to the level surface

by locating the driving shaft AS, to which the driving wheel 14 of the crawler 2 is attached, above the rotating shaft 4a of the roll 4.

In the FIG. 1A, the vibratory roller 1, the front direction of which is inclined to downward with respect to the level tread having a inclined angle θ, is shown. In this vibratory roller 1, it is designed so that the vehicle body 3 may be in the level condition to the tread, when the tire T is attached for the compaction in the level ground.

When the compaction using the crawler 2 is carried out in the sloping ground of degree α in sloping angle (conventionally, compaction in the sloping ground is carried out on locating the roll 4 in the upward direction), in the case of the conventional vibratory roller, the vehicle body 3 is inclined at same degree as the sloping angle of the sloping ground, as shown in FIG. 8. On the other hand, according to the present invention, since the vehicle body 3 is inclined at the degree (α-θ), which is obtained by deducting the inclination degree θ of the vehicle body 3, the degree of the mental pressure caused by the inclination of the vehicle body 3 will be decreased. The inclination of the cab seat 7 is also decreased by degree θ as compared to the conventional, thus the fatigue degree of the operator is also decreased.

A perpendicularly vibratory mechanism 112, which vibrates the roll 4 only in the perpendicular direction to the ground surface, is installed within the roll 4. FIG. 9 is a

schematic block diagram view showing an example of the perpendicular vibrator mechanism 112.

A vibrating shafts 113A and 113B of couple are installed within the roll 4 at the same height location from the ground so that it may become parallel mutually along the longitudinal (the front-and-back direction in FIG. 9) of the roll 4 with the well-known manner. The vibrating shaft 113A and 113B are supported within the roll 4 so that they can synchronously rotate in the reverse direction mutually, and the eccentric weight 114A and 114B are attached thereto.

The mutual relation and the eccentrically location of the eccentric weight 114A and 114B will be explained. As shown in FIG. 9A, the eccentric weight 114A and 114B are fixed to the vibrating shaft 113A and 113B, respectively, so that the eccentric weight 114A and 114B have the phase difference of 180-degrees when the eccentric weight 114A and 114B are made into the level condition.

Therefore, since the vibrating shaft 113A and 113B are synchronously rotate in the reverse direction mutually, the eccentric weight 114A and 114B are located upward together in the case of FIG. 9B. Thus, the vibrating force, which affects in the symbol U direction (upper direction), is applied to the tread of the roll 4. On the other hand, the eccentric weight 114A and 114B are located downward together in the case of FIG. 9D. Thus, the vibration force, which affects in the symbol D direction (lower direction), is applied to the tread of the roll

4.

In the case of FIG. 9A and FIG. 9c, since the eccentric weights 114A and 114B are located in the opposite phase, a centrifugal force thereof is offset mutually, and thus the vibration force is not brought to the roll 4. As shown in FIG. 9, the phase of the eccentric weight 114A and 114B are in agreement only when the eccentric weight 114A and 114B are located in the directly above or directly below direction. Thus, when the phase of the eccentric weight 114A and 114B are in agreement, since the centrifugal force of them are combined, the roll 4 is vibrated only in the perpendicular direction (the direction perpendicular to the ground surface).

FIG. 11A is a graph showing the wave profile in the ups-and-downs and front-and-rear directions of the vibration acceleration, which is applied to the roll 4 by the perpendicular vibrator mechanism 112. FIG. 11B is a graph showing the wave composite of the vibration acceleration. As can be seen in FIG. 11B, the wave composite of the vibration acceleration is displacing along the locus of only in the ups-and-down direction with respect to the ground on regarding the shaft center of the roll 4 as center. Thus the compaction of the ground can be carried out under the stabilized condition, and also superior operationablity of sterling wheel can be accomplished.

When the compaction of the sloping ground is carried out using the vibratory roller 1, equipped with the roll 4 explained

above, while climbing the sloping ground, that is, when the compaction is carried out along the manner where the compaction is carried out by vibrating the roll only in the perpendicular direction with respect to the ground surface of the sloping ground while driving the vibratory roller 1 using the crawler, the following effects will be given.

As shown in FIG. 10, since the reaction force applied to the roll 4 from the ground is only in the perpendicular direction with respect to the ground, the reaction force of the front-and-rear directions to the vehicle body 3 is decreased as compared to the conventional. Thus, the shaky movement of the vehicle body 3 is decreased, and the keeping of the attitude of the vehicle body 3 into stabilized condition can be achieved.

Therefore, getting off of the balance of the vehicle body 3 and the difficulty of the steering operation of the sterling handle, which is caused by the amplification of the gravity with the unbalance of the vehicle body 3, are not arisen even in the steep sloping ground of more than 20-degree. The problem that the keeping of the attitude of the vehicle body 3 becomes difficult is settled.

Also, since the vibratory roller 1 drives using the crawler 2, the superior trafficability (the ability of the running the whole distance) as compared to the vibratory roller equipped with the tire T and suitable keeping of the rectilinearity in the steep sloping ground are given. Thus, stability of the vehicle body 3 is also improved, and then the

feeling of insecurity caused by the unstableness of the vehicle body 3 on the steep sloping ground is relieved

According to the present invention, the following effectiveness will be given.

1) According to the roller, in which a pair of driving wheels attached on both sides of a driving shaft of the crawlers, each of said driving wheels being detachable from the driving shaft; a set of right-and-left driven wheels for the crawlers arranged on both sides of the (vehicle) body; and a connecting member integrally supporting the set of right-and-left driven wheels, said connecting member is attached on a bottom of the (vehicle) body and is detachable from the (vehicle) body with the set of driven wheels attached thereto, the detaching operation of the crawler from the vehicle body will be achieved with ease as compared to the conventional.

2) According to the roller, in which crawlers are replaceable with a pair of tire, and each of said tires being detachable from driving shaft, when the selection between the tire and the crawler is carried out depends on the condition of the ground to be compacted, the traveling performance will be fully demonstrated. Since the compaction is achieved only one vehicle without serving a plurality of the vehicles, furthermore, the roller exceeds in economical efficiency can be obtained.

3) According to the roller, in which a vibratory roll is connected to the (vehicle) body in an articulating manner, and

wherein said driving shaft positions above a rotating shaft of the vibratory roll so that the (vehicle) body inclines with respect to the horizontal plane, the degree of the inclination of the vehicle body on the sloping ground in the case of the compacting execution will be smaller. Since the degree of the inclination angle of the vehicle can be smaller, the degree of the mental pressure, which is given to the operator himself by the inclination of the vehicle body, is alleviated.

According to the roller and the compaction method of the sloping ground using the vibratory roller, since stability of the vehicle body 3 is also improved, and then the feeling of insecurity caused by the unstableness of the vehicle body 3 on the steep sloping ground is relieved.